



TUBE

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HAM NEWS

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PEE WEE POWERHOUSE

6 Watt Miniature Tube Audio Amplifier Contained in Mike Stand

ELECTRICAL CIRCUIT

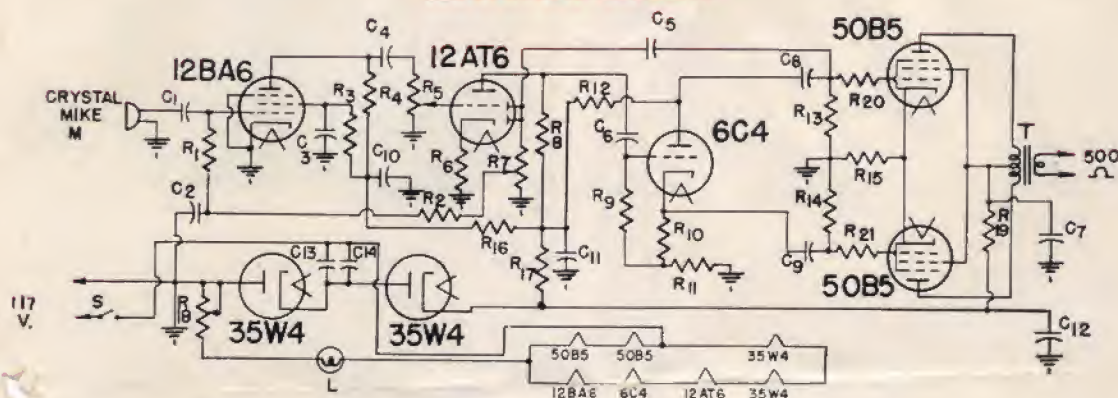


Fig. 1—Circuit Diagram of 6 watt Audio Amplifier

CIRCUIT CONSTANTS

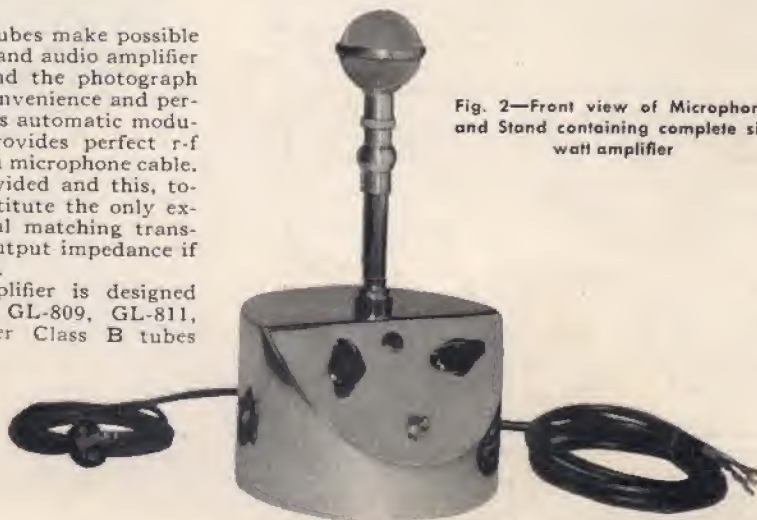
$C_1, 4, 6 = 0.02$ mf., 400 volt paper
 $C_2, 3, 5 = 0.1$ mf., 400 volt paper
 $C_7, 11, 14 = 16$ mf., 450 volt dry electrolytic
 $C_8, 9 = 0.01$ mf., 400 volt paper
 $C_{10}, 12, 13 = 8$ mf., 450 dry electrolytic
 $L = 2.5$ volt, 0.500 amp pilot light
 $M =$ Brush crystal microphone, BR2S
 $R_1, 2, 9 = 1$ megohm, $\frac{1}{2}$ watt
 $R_4 = \frac{1}{4}$ megohm, $\frac{1}{2}$ watt
 $R_{14}, 17 = \frac{1}{2}$ megohm potentiometer
 $R_{16}, 17 = 2000$ ohm, $\frac{1}{2}$ watt

$R_{18}, 11 = 50,000$ ohm, $\frac{1}{2}$ watt
 $R_{19}, 13, 14 = \frac{1}{2}$ megohm, $\frac{1}{2}$ watt
 $R_{10}, 16 = 5000$ ohm, $\frac{1}{2}$ watt
 $R_{12} = 50,000$ ohm, 1 watt
 $R_{15} = 125$ ohm 1 watt
 $R_{18} = 100$ ohm, 10 watt with slider
 $R_{19} = 400$ ohm, 10 watt
 $R_{20}, 21 = 1000$ ohm, $\frac{1}{2}$ watt
 $S =$ Sp-st toggle switch
 $T =$ Universal output transformer (UTC S-18)

General Electric miniature tubes make possible the construction of the mike-stand audio amplifier shown in the circuit above and the photograph below (Fig. 2). Designed for convenience and performance, this unit incorporates automatic modulation control (AMC) and provides perfect r-f shielding due to the absence of a microphone cable. A 500 ohm output line is provided and this, together with the a-c cord, constitute the only external connections. A universal matching transformer permits changing the output impedance if a 500 ohm output is undesirable.

The mike-stand audio amplifier is designed to drive a pair of Class B GL-809, GL-811, GL-812, GL-805 or any other Class B tubes requiring 6 watts of drive or less. In on-the-air tests this unit furnished adequate drive to a pair of GL-805 tubes in Class B (plate voltage 1250 volts) to modulate a 900-watt carrier.

Fig. 2—Front view of Microphone and Stand containing complete six watt amplifier



CIRCUIT DETAILS

The new General Electric miniature tubes are used throughout the circuit, as may be seen by referring to Fig. 1. The semi-remote cut-off 12BA6 stage is designed around a new high transconductance amplifier tube which provides high gain as a voltage amplifier. This gain may be controlled over a wide range by varying the grid bias. A semi-remote cut-off tube is used in this stage rather than the conventional sharp cut-off pentode to allow smooth distortionless AMC action. The 12AT6 stage fulfills a dual purpose. It serves as the second amplifier stage and also as a diode rectifier to supply the AMC bias for the grid of the 12BA6.

The AMC voltage is taken from the grid of the

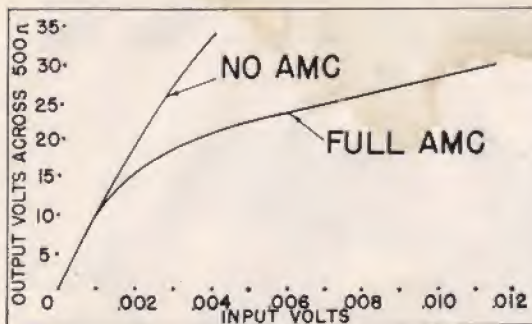


Fig. 3—Automatic Modulation Control Characteristic

50B5 stage. Control R5 is the conventional gain control while R7 is the AMC voltage control. Fig. 3 shows the effect of the AMC control on the amplifier output.

Phase inversion for driving the push-pull 50B5 stage is accomplished by the use of a 6C4 cathode follower. This stage uses a minimum of parts and space and yet offers good frequency response. The output stage is a standard Class A amplifier stage and provides up to 6 watts of low distortion output.

The power supply circuit uses two 35W4 rectifier tubes connected in a voltage doubling arrangement. This provides more than adequate voltage for rated operation but it was found that humless operation in a circuit of this type can only be achieved by the use of series resistors and large filter capacitors. The loss of voltage across the series resistors necessitates starting with a high supply voltage.

The tube filaments are connected to form two series strings of 100 volts each, the remainder of the line voltage being compensated for by the adjustable resistor, R18. It is important that the 12BA6 filament be connected as shown in order to be as close to the grounded side of the a-c line as possible.

PERFORMANCE CHARACTERISTICS

The frequency response curve for the entire amplifier from microphone to the 500 ohm line is shown in Fig. 4. This curve indicates the high

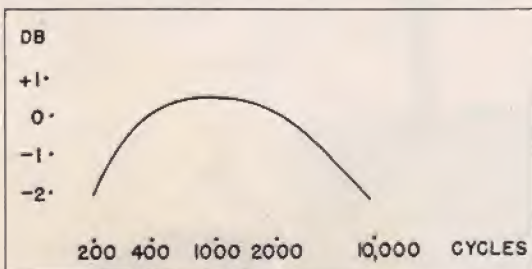


Fig. 4—Frequency-Response Characteristic

fidelity that may be achieved with this straight forward design. As a matter of fact, for communication work it would be desirable to cut off the frequency response at a much lower frequency than the amplifier is capable of reproducing.

The various plate voltages with 117 volts a-c input to the amplifier, as measured with a vacuum-tube voltmeter, should be close to: 12BA6, 70 V; 12AT6, 135 V; 6C4, 130 V; 50B5, 130 V. With these plate voltages, the voltage gain in each stage should be: 12BA6, 100; 12AT6, 16; 50B5, $6\frac{1}{2}$. Under these conditions 6.1 watts output can be obtained.

CONSTRUCTIONAL DETAILS

The unit is built into a stand which is 7 inches in diameter and 4 inches high. Fig. 5 indicates the chassis layout. The top two tubes are the 50B5 tubes, with the 6C4 below, the 12BA6 in the

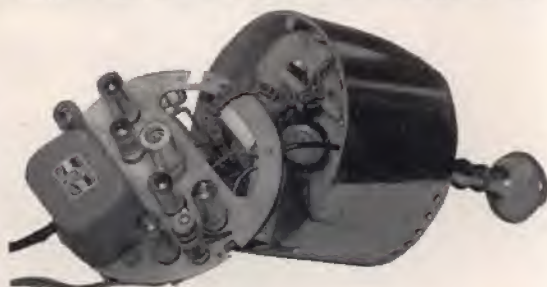


Fig. 5—View Showing Mechanical Arrangement of Stand

shield, and the 12AT6 next. The 35W4 tubes are placed on each side of R18. The ventilating holes may also be seen clearly in Fig. 5.

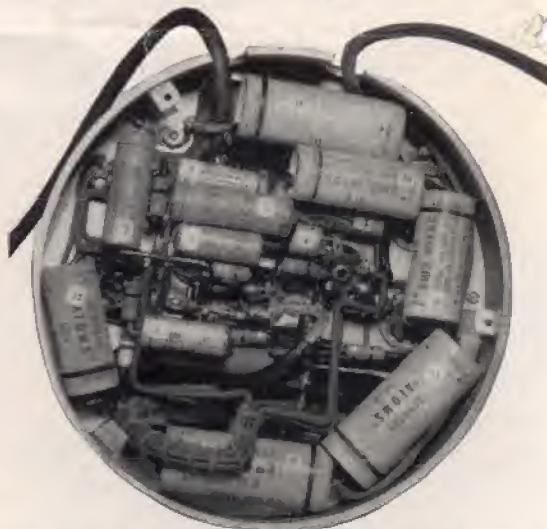


Fig. 6—Bottom View of Amplifier Showing Parts Layout

Fig. 6 gives a view of the bottom of the speech amplifier. C₁, which is mounted inside the microphone support is not visible. Other capacitors may be identified by number. The placement of parts was not found to be critical.

It is extremely important that the metal frame of the amplifier be grounded to earth ground. This is best accomplished by using a two-wire, shielded cable for the 500 ohm line, using the shield as a ground connection. When this is done, the a-c plug should be polarized to prevent incorrect insertion. If an incorrect connection is made to the a-c line, the ground connection insures that the circuit fuse will blow.

QUESTIONS AND ANSWERS



Do you have any questions about tubes or tube circuits? Lighthouse Larry would like to answer them for you. For each question published you will receive \$10 worth of G-E electronic tubes. All questions not published will be answered promptly by mail. Send your questions to Lighthouse Larry, Tube Division, Bldg. 269, General Electric Company, Schenectady, New York, or in Canada, to Canadian General Electric Company, Ltd., Toronto, Ont.

Question: (a) Do tubes deteriorate if idle for a long period? (b) Does it reduce the life of tubes to operate them in a horizontal position? . . . W8JAH

Answer: (a) In general, transmitting tubes will not deteriorate on the shelf. There are several exceptions, however. Tubes with oxide-coated filaments are more likely to go bad than tubes with tungsten filaments, due to flaking of the oxide coating. Further, if a tube is a very slow leaker, it will, of course, be bad after a long shelf life.

Several precautions should be observed when placing tubes in service again especially if the tubes are high-voltage tubes. The filament should be lit and the tube run this way for a few minutes. Following this, one-half normal plate voltage should be applied and the tube operated for several more minutes. After this, full plate voltage may be applied.

It is a good idea to test your spare tubes in this

manner periodically in order to ensure that they are still operable.

(b) It does not reduce the life of a tube to operate it horizontally if that tube is designed to be run in that manner. For example, the 6L813 may be operated in a horizontal position if the anode is in a vertical plane (on edge). —Lighthouse Larry.

Question: As the frequency is continually increased will various tubes reach a certain limiting frequency and cut out in all their functions simultaneously or will certain tubes amplify at higher frequencies than they would oscillate or vice versa?—W8CIL.

Answer: Every tube has its own resonant frequency—that is, a maximum frequency at which it will oscillate. This limit is brought about by tube capacitance and inductance and at this limiting frequency the entire circuit is effectively contained within the tube envelope.

It is possible that a tube would act as an amplifier at a slightly higher frequency than it could oscillate, but the difference in these two frequencies would be small. The important point is that the efficiency at these limiting frequencies is so very poor that it would not be practical to operate the tube at frequencies even close to the limiting or resonant frequency of the tube. —Lighthouse Larry.



TRICKS AND TOPICS

How did you solve that last problem that almost had you stumped? Be it about tubes, antennas, circuits, etc., Lighthouse Larry would like to tell the rest of the hams about it. Send it in! For each "trick" accepted you win \$10 worth of G-E Electronic Tubes. No entries returned. Submit to Lighthouse Larry, Tube Division, Bldg. 269, General Electric Company, Schenectady, New York or in Canada, to Canadian General Electric Company, Ltd., Toronto, Ont.

R-F Choke Trick

Here is a little stunt that may be useful to the ham on the U-H-F bands. In trying to ascertain whether or not a choke is actually a choke, test it in this manner. Connect the choke in series with a 0.060 ampere pilot light and a pickup loop. Couple the loop to the tank circuit of your U-H-F transmitter. If the lamp does not light, no U-H-F energy is being passed by the R-F choke and it is suitable for use on that band. A more sensitive indicator, such as a vacuum-tube voltmeter, could be used in place of the pilot lamp.—W3KAK.

Bias Supply Trick

To provide an inexpensive power transformer for a grid bias supply of the order of 50 to 100

volts a filament transformer may be used. What was intended for a 6.3 volt (any voltage may be used) secondary is connected across the 6.3 volt heater supply of one of the tubes in the rig. The 115 volt primary then may be used to supply voltage to the plates of a 6X5 as a half-wave rectifier. A simple filter smooths out the ripple and a fixed bias of approximately 60 to 70 volts is obtained. (Eds. note: More voltage can be obtained if large filter capacitors are used.—L.L.) The fixed bias is available as the filaments are energized. This method of obtaining bias voltage has a great advantage over the transformerless type of supply as the a-c line is isolated.—W3FDJ.

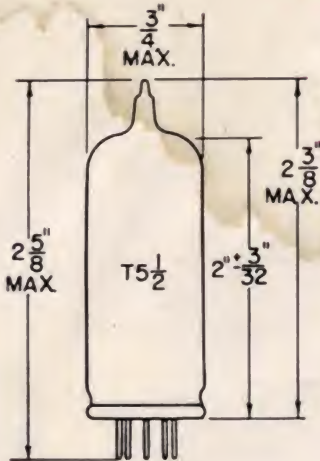
GRP Trick

For a quick, inexpensive way to reduce power for making transmitter adjustments, insert a 1000 watt electric heater unit in series with the primary of your plate transformer. There is a type available which screws into an ordinary lamp socket and can be wired with a toggle switch in parallel to cut the heater unit in and out. This method has the advantage over a large lamp bulb in that no bothersome light is produced.—W3HWF.

CONDENSED DATA

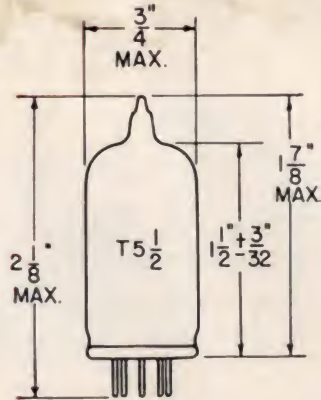
	6C4	12AT6	12BA6	35W4	50B5	UNITS
Heater Voltage.....	6.3	12.6	12.6	35.0	50.0	volts
Heater Current.....	0.15	0.15	0.15	0.15	0.15	ampere
Maximum Plate Voltage.....	330	330	330	365	130	volts

PHYSICAL DIMENSIONS



RMA 5-3

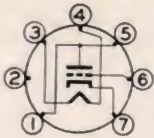




Outline 50B5 and 35W4



RMA 5-2

Outline 6C4, 12AT6 and 12BA6

BASING DIAGRAMS—PIN CONNECTIONS

6C4	12AT6	12BA6	35W4	50B5
				
RMA 6BG Bottom View	RMA 7BT Bottom View	RMA 7BK Bottom View	RMA 5BQ Bottom View	RMA 7BZ Bottom View
Pin 1—Plate Pin 2—Internal Connection Pin 3—Heater Pin 4—Heater Pin 5—Plate Pin 6—Grid Pin 7—Cathode	Pin 1—Triode Grid Pin 2—Cathode Pin 3—Heater Pin 4—Heater Pin 5—Diode Plate Number 2 Pin 6—Diode Plate Number 1 Pin 7—Triode Plate	Pin 1—Grid Number 1 Pin 2—Grid Number 3 and internal Shield Pin 3—Heater Pin 4—Heater Pin 5—Plate Pin 6—Grid Number 2 (Screen) Pin 7—Cathode	Pin 1—No Connection Pin 2—No Connection Pin 3—Heater Pin 4—Heater Pin 5—Plate Pin 6—Heater Tap Pin 7—Cathode	Pin 1—Grid Number 1 Pin 2—Cathode and Beam Plates Pin 3—Heater Pin 4—Heater Pin 5—Plate Pin 6—Grid Number 2 Pin 7—Grid Number 1

Electronics Department

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